PN 69-4540 (7)

DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010

CPT Rowden/aiv/AUTOVON
584-2925

REPLY TO
ATTENTION OF

HSHB-OA

26 JUL 1984

SUBJECT: Health Hazard Assessment Report on Permethrin as an Insect/Arthropod Repellent Applied to Military Clothing

HQDA (DASG-PSP-E)
WASH DC 20310

HDA FILE

1. Reference letter, DASG-PSP-E, OTSG, 1 June 1984, subject: Health Hazard Assessment of Permethrin as an Insect/Arthropod Repellent Applied to Military Clothing, with inclosure thereto.

2. As requested in the above reference, a health hazard assessment has been completed on subject system (inclosure).

3. The lead project officer responsible for preparation of this report was CPT Roger McIntosh, M.D., Occupational and Environmental Medicine Division, AUTOVON 584-2714.

FOR THE COMMANDER:

original signed by
for Rodney M. Atack
JOEL C. GAYDOS, M.D.
Colonel, MC
Director, Occupational and
Environmental Health

1 Incl
as

CF:
Cdr, HSC (HSCL-P)

HEALTH HAZARD ASSESSMENT REPORT (RCS MED 388) ON PERMETHRIN AS AN INSECT/ARTHROPOD REPELLENT APPLIED TO MILITARY CLOTHING 69-37-4540-84

1. References. A list of references used in this Health Hazard Assessment Report (HHAR) is contained in the Appendix.

2. Summary. Use of permethrin, an arthropod toxicant, for clothing impregnation has been evaluated. Benefits of permethrin impregnation alone or in combination with a topical insect repellent have been demonstrated. Clothing impregnation with permethrin at a concentration of 0.125 mg/cm^2 of cloth appears safe for human use and is recommended. Other aspects of assessment with recommendations are included in paragraphs 5 and 6.

3. Background. Currently available repellents for use as clothing impregnants include the standard repellent, N,N-diethyl-m-toluamide (deet) and mixture M-1960 (30% 2-butyl-2-ethyl-1,3-propanediol; 30% benzyl benzoate; 30% N-butylacetanilide and 10% nonionic emulsifier) (references 1 and 2). Use of arthropod toxicants as a means of personal protection against blood-feeding arthropods has been studied more recently (reference 3). Permethrin, a synthetic pyrethroid, has been identified as a desirable alternative for clothing impregnation based upon durability (reference 3), spectrum of action and low level of mammalian toxicity. Permethrin does not act as a simple repellent but, as a toxicant, results in rapid "knockdown" of susceptible arthropod species. After 10 to 20 minutes of use in a region, it appears to result in a degree of relative area protection (reference 4). Since it does not serve as a simple repellent, insects may actually land on hosts; however, the toxic effects of permethrin usually induce behavioral changes or death on the insect before probing (feeding) is initiated (references 5 and 6). Investigational human use of permethrin has been associated with minimal undesirable side effects, in contrast to use experiences with M-1960 (references 6 and 7). Improved formulations of deet for user acceptance are under evaluation (reference 8) and beneficial protective effects of combined use of clothing impregnation with permethrin and topical application of deet have been clearly demonstrated (references 2 and 9). As a result of the apparent entomological and user benefits of permethrin, a HHA was requested concerning its use and potential methods of clothing impregnation (reference 10).

4. Identification of Health Hazard Issues.

   a. Permethrin toxicology.

   b. Impregnation method hazard.

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5. Assessment of Health Hazard Issues.

a. Permethrin toxicology. A review of available literature concerning permethrin toxicology reveals no evidence that the compound poses any adverse hazard to users in the proposed use formulation of 0.125 mg/cm^2 on clothing (reference 11, 12, and 13). Acute and subchronic studies have been interpreted to predict no adverse human effect. Cutaneous, ocular, fetotoxicity, teratology and mutagenicity studies are interpreted as negative (references 11 and 12). Although there is controversy concerning tumorigenic potential in some animal models, the Environmental Protection Agency has determined that "the likelihood that permethrin would produce oncogenic effects in humans is nonexistent or extremely low" (references 14 and 15). Permethrin can be absorbed through intact skin; however, the relatively low concentration and documented durability (persistence in clothing) minimize exposure potential. The health benefits of minimizing exposure to potential arthropod vectors of disease are apparent.

b. Impregnation method hazards. Complete details concerning each proposed type of impregnation for clothing are not yet available. Intuitively, exposure to soldiers would appear to be minimized if impregnation was associated with material manufacture to assure quantitative permethrin quality control. Impregnation of all materials may not be desirable for all use situations and this may represent a limitation for impregnation during manufacture. While field laundry or individual soldier application for permethrin impregnation have clear advantages for the selective, specific military use scenario, the increased risk of accidental or intentional exposures to larger quantities of permethrin or potential solvents is apparent. Safe methods of field applications of permethrin are currently being investigated by the US Army Natick Research and Development Center and development appears feasible (reference 8).

6. Recommendations.

a. Permethrin toxicology. Recommend approval for clothing impregnation with permethrin at a concentration of 0.125 mg/cm^2.

b. Impregnation method hazard. Recommend clarification of process details for each proposed method be provided for review.

7. Proponent. This HHA was prepared by the US Army Environmental Hygiene Agency (USAEHA), Aberdeen Proving Ground, MD 21010, July 1984. Point of contact is CPT Roger McIntosh, M.D., Occupational and Environmental Medicine Division, AUTOVON 584-2714.

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APPENDIX

REFERENCES

1. Lindsay, I. S. and J. M. McAndless, "Permethrin-Treated Jackets versus Repellent-Treated Jackets and Hoods for Personal Protection Against Black Flies and Mosquitoes," Mosquito News 38: 350-356, 1978.

2. Schreck, C. E., N. Smith, D. Weidhass, K. Posey, and D. Smith, "Repellents versus Toxicants as Clothing Treatments for Protection From Mosquitoes and Other Biting Flies," Journal of Economic Entomology 71: 919-922, 1978.

3. Schreck, C. E., K. Posey, and D. Smith, "Durability of Permethrin as a Potential Clothing Treatment to Protect Against Blood-Feeding Arthropods," Journal of Economic Entomology 71: 397-400, 1978.

4. McAndless, J. M. and I. S. Lindsay, Research and Development Branch Department of National Defense Canada, DREO Report No. 767 Pyrethroid-Treated Jackets versus Repellent-Treated Jackets and Hoods for Personal Protection Against Biting Flies, November 1977.

5. Bar-Zeen, M., "Studies of Repellents Against Panstrongylus megistus (Hempters: Reduviidae) in Brazil," Journal of Medical Entomology 17: 70-74, 1980.

6. Schreck C. E., E. L. Snoddy, and G. A. Mount, "Permethrin and Repellents as Clothing Impregnants for Protection from the Lone Star Tick," Journal of Economic Entomology 73: 436-439, 1980.

7. Breeden, G. L., C. E. Schreck, and A. L. Sorensen, "Permethrin as a Clothing Treatment for Personal Protection Against Chigger Mites (Acarina: Trombiculidae)," Am. J. Trop Med Hyg 31: 589-92, 1982.

8. FONECON between Col John Reinert, US Army Medical Research and Development Command, Fort Detrick and MAJ T. Weyandt, USAEHA, 28 June 1984, subject: HHA for Permethrin.

9. Schreck, C. E., D. G. Haile, and D. L. Kline, "Field Tests with Permethrin-Treated Clothing and/or Deet for Protection from Natural Infestations of Aedes taeniorhynchus (Wiedemann)."

10. Letter, SGRD-DPM, US Army Medical Research and Development Command, 24 May 1984, subject: Health Hazard Assessment of Permethrin as an Insect/Arthropod Repellent Applied to Military Clothing.

11. Letter, HSE-LT/WP, USAEHA, 2 December 1977, subject: Toxicological Evaluation of Candidate Insect Repellent AI3-29158, Study No. 51-0831-78, December 1975 - April 1977.

12. Letter, HSE-LT/WP, USAEHA, 23 April 1980, subject: Subchronic Inhalation Toxicity of 3-(Phenoxyphenyl) Methyl (+)-Cis, Trans-3-(2,2-Dichloroethenyl)-2,2-Dimethylcyclopropanecarboxylate (Permethrin), Study No. 75-51-0026-80, May-December 1978.

13. Letter, HSHB-OM, USAEHA, 14 February 1984, subject: Toxicology Tests on Permethrin.

14. Some Permethrin Tolerance Set; EPA Reiterates Stand on Oncogenicity, Pesticide and Toxic Chemical News, 6 October 1982, p 16-17.

15. Report, Toxicity Branch, Environmental Protection Agency, Permethrin Assessment of Chronic and Oncogenic Effects, A Summary, 3 September 1982.

69-37-4540

DEPARTMENT OF THE ARMY
OFFICE OF THE SURGEON GENERAL
WASHINGTON, DC 20310

REPLY TO ATTENTION OF

DASG-PSP-E

1 June 1984

SUBJECT: Health Hazard Assessment of Permethrin as an Insect/Arthropod Repellent Applied to Military Clothing

Commander
US Army Environmental Hygiene Agency
ATTN: HSHB-OA
Aberdeen Proving Ground, MD 21010

1. Reference letter, SGRD-DPM, 24 May 1984 SAB.

2. Referenced letter is forwarded your Agency for preparation of requested Health Hazard Assessment Report. Direct coordination with MRDC is authorized.

3. In order to meet Military developmental needs your reply should reach this office NLT 8 September 1984.

4. POC this office is LTC V.R. Sherman, AV 227-2796.

FOR THE SURGEON GENERAL:

Bruce A. Dalton for

MANMOHAN V. RANADIVE, M.D.
Colonel, MC
Chief, Preventive Medicine
Consultants Division

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as

CF:
MRDC (SGRD-PLC)

CPT Kowalski
Sue Guy
File
4540

DASG-PSP (24 May 84) 1st Ind
SUBJECT: Health Hazard Assessment of Permethrin as an Insect/Arthropod Repellent Applied to Military Clothing

HQDA (DASG-PSP) WASH DC 20310-2300 1 AUG 1984

TO: CDR, US Army Medical Research and Development Command, ATTN: SGRD-DPM/ LTC(P) Reinert, Fort Detrick, Frederick, MD 21401

1. A health hazard assessment of the subject material was conducted by the US Army Environmental Hygiene Agency and this office. The assessment is attached as the inclosure.

2. The assessment report identified two potential health hazards: permethrin toxicology and impregnation method hazard. Even though permethrin can be absorbed through intact skin, the permethrin toxicity is mitigated by the relatively low concentrations used and its documented durability in clothing. The impregnation method hazard potential still needs to be evaluated once process details are clarified on various alternatives.

3. Recommendations for controlling identified hazards are found in paragraph six of the assessment report.

4. Although no risk assessment code can yet be assigned to the impregnation method hazard, it is felt that options can be developed with very little risk to the individual. Therefore, it is recommended that MRDC proceed with item development.

5. Questions concerning this assessment may be addressed to LTC H. M. McAlear, this office at AV 227-2796 or to CPT R. McIntosh, USAEHA, AV 584-2714.

FOR THE SURGEON GENERAL:

M. V. Ranadive M.D.

1 Incl
as

MANMOHAN V. RANADIVE, M.D.
Colonel, MC
Chief, Preventive Medicine
Consultants Division

CF:
→ CDR, USAEHA, ATTN: HSHB-OA (w/o incl)
CDR, USAMRDC, ATTN: SGRD-PLC

DEPARTMENT OF THE ARMY
US ARMY MEDICAL RESEARCH AND DEVELOPMENT COMMAND
FORT DETRICK, FREDERICK, MD 21701

REPLY TO ATTENTION OF:

SGRD-DPM

24 May 1984

SUBJECT: Health Hazard Assessment of Permethrin as an Insect/Arthropod Repellent Applied to Military Clothing

THRU: Commander
US Army Medical Research and Development Command
ATTN: SGRD-DPM/COL Dangerfield, Director
Fort Detrick
Frederick, MD 21701

25 May 84

TO: HQDA(DASG-PSP)
WASH DC 20310

1. Reference:

a. AR 40-10, Health Hazard Assessment Program in Support of the Army Material Acquisition Decision Process, 15 September 1983.

b. AR 1000-1, Basic Policies for Systems Acquisition, 1 May 83.

2. Request The Surgeon General, US Army, provide a Health Hazard Assessment for Permethrin as an Insect/Arthropod Repellent Applied to Military Clothing and/or to other military materials. Assessment should include various methods of application.

3. A Health Hazard Assessment is needed at this time so that the US Army Medical Research and Development Command can proceed with the development of this item.

4. Basic information and toxicological and efficacy reports on permethrin concerning its use as an Insect/Arthropod repellent are attached (Incl 1, 2, and 3).

SGRD-DPM 24 May 1984
SUBJECT: Health Hazard Assessment of Permethrin as an Insect/Arthropod Repellent Applied to Military Clothing.

5. The completed Health Hazard Assessment should be provided to Commander, US Army Medical Research and Development Command, ATTN: SGRD-DPM/LTC(P) John F. Reinert, Fort Detrick, Frederick, MD 21701.

JOHN F. REINERT, Ph.D.
LTC(P), MSC
Product Manager for Arthropod Repellents

3 Incl
as

CF:
CDR, USAEHA, ATTN: HSHB-OA
CDR, USAMRDC, ATTN: SGRD-PLA/PLC